



Micropulse Laser for Persistent Sub-Retinal Fluid in a Patient Previously Treated for Rhegmatogenous Retinal Detachment

Gennady Landa ^{1,2*}

¹ Department of Ophthalmology, New York Eye and Ear Infirmary of Mount Sinai, New York, NY, USA

² Icahn School of Medicine at Mount Sinai, New York, NY, USA

ABSTRACT

The purpose of this study was to report the resolution of persistent Sub-Retinal Fluid (SRF) induced by subthreshold micropulse laser treatment in a patient, formerly treated for rhegmatogenous retinal detachment by retinal pneumopexy. The case was a 41-year-old male, who initially presented macula-splitting rhegmatogenous retinal detachment and corrected distance visual acuity of 20/40 in his left eye. He was treated by retinal pneumopexy and laser retinopexy. Retina was flattened and vision improved to 20/30. However, the subretinal fluid (SRF) under the fovea was persistently observed on repeated retinal exams. Fourteen months after the initial pneumopexy, subthreshold micropulse laser was applied to cover the entire area of the SRF. The improvement started two weeks afterwards and the SRF completely resolved within four months after the application of micropulse laser. Corrected distance visual acuity improved from 20/30 to 20/20, accompanied by marked improvement in patient's complaints on visual blurriness. The patient was followed up for three years and no recurrence of SRF was noted. The findings of this report indicate that subthreshold micropulse laser may serve as a therapeutic option for persistent SRF, which may be observed after successful retinal detachment repair.

KEYWORDS

Rhegmatogenous Retinal Detachment; Subretinal Fluid; Retinal Pneumopexy; Micropulse Laser

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Correspondence to:

Gennady Landa, MD, Department of Ophthalmology, New York Eye and Ear Infirmary of Mount Sinai, New York, NY, USA. E-mail: doctor.landa@gmail.com

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INTRODUCTION

Retinal detachment repair procedures can be followed by non-resolution of Subretinal Fluid (SRF), especially when the surgical procedure doesn't involve internal or external drainage of SRF [1, 2]. Desatnik et al. identified the incidence of delayed SRF absorption in seven (4.3%) out of 160 patients, who underwent pneumatic retinopexy [3]. The complete resolution of SRF can take

up to several months or even years [3, 4]. Some authors found that the presence of postoperative SRF might delay visual recovery, however, it did not seem to influence final visual outcome [1, 5]. Other authors demonstrated that persistent SRF might impose a detrimental effect on photoreceptors by delaying visual recovery and by causing structural changes in



photoreceptors, resulting in poorer visual prognosis and worse visual outcome after the complete resolution of SRF [4, 6-9]. It is believed that persistent SRF should be managed conservatively by observation [3], however, other therapeutic approaches [10-12] that have been proposed in the literature in order to expedite the resolution of SRF, through both safety and efficacy, remain unclear. Conventional laser treatment has been attempted in the past yet it did not seem to achieve immediate results [3, 13]. Subthreshold Micropulse Laser (MPL) was found safe and effective in many macular diseases, especially when used for successful absorption of SRF in chronic Central Serous Retinopathy (CSR), by inducing a biological response on Retinal Pigment Epithelium (RPE) cells, which promotes recovery and restoration of the outer blood-retinal barrier and accelerates the resolution of the SRF [14-19]. Subthreshold MPL produces therapeutic effects that appear comparable to those of conventional laser with no detectable signs of laser-induced iatrogenic damage [20]. The purpose of this manuscript was to report the outcome of MPL application for persistent SRF in a patient, who had been previously treated for retinal detachment.

MATERIALS AND METHODS

The case was a 41-year-old male, who initially presented complaints of blurry vision and nasal visual field defect in the left eye. The symptoms started two weeks prior to his referral. His ocular, systemic, and family histories were unremarkable, except for mild myopia. On presentation, Corrected Distance Visual Acuity (CDVA) was 20/40. The rest of anterior segment exams were within normal limits. On fundus examination, there was evidence of macula-splitting superior Rhegmatogenous Retinal Detachment (RRD), involving superonasal, superotemporal, and inferotemporal quadrants with two adjacent superior retinal breaks and area of lattice with no holes, inferiorly. Spectral Domain Optical Coherence Tomography (SD-OCT) (Cirrus 5000, Carl Zeiss Meditec Inc., Dublin, CA, USA) demonstrated SRF sub-foveally and central foveal retinal thickness of 553 microns. The patient underwent retinal pneumopexy with injection of 0.5 cc of undiluted C3F8 (perfluoropropane) gas. Retina was flattened and laser retinopexy was performed around retinal breaks and lattice. Corrected distance visual acuity improved to 20/30-. However, the SRF under the fovea was persistently observed on his repeated retinal exams. The patient maintained face-down positioning with no improvement in SRF, even after additional pneumopexy (0.5 cc undiluted C3F8) and laser retinopexy (360 degrees of laser barrage was

completed), which were repeated after one month. Although his visual acuity remained stable at 20/30, the patient reported visual disturbance during each visit. During the follow-up, it was noted that persistent submacular fluid had been gradually building up, yet repeated meticulous exams of retinal periphery under scleral depression on each visit showed no evidence of retinal defects. The treatment options, which included repeated pneumopexy, vitrectomy or buckle, were discussed with the patient on multiple occasions and the patient insistently refused any surgical intervention, despite unremitting subjective complaints of blurry vision in this eye. Increase in the amount of SRF was correlated with increase of blurry vision complaints during the follow-up. Subthreshold micropulse laser was offered to the patient. Since no subsequent head positioning was required and no intravitreal gas injection, preventing patient's frequent travels, was needed, the patient expressed his willingness to undergo the procedure and gave informed consent, understanding the risks. Fourteen months after the initial pneumopexy, subthreshold MPL (577 nm yellow laser, Iridex IQ 577™, Mountain View, CA, USA) was successfully applied to cover the entire area of the SRF, using established parameters (200 micrometer spot diameter, 0.20 second duration, 10% duty cycle, 200 milliwatt power, 9 grids of 7x7 pattern, and total of 441 spots). Ethical issues were completely observed by the author.

RESULTS

The improvement in SRF and clinical symptoms were started two weeks later and the SRF had resolved within four months after the application of MPL. Corrected distance visual acuity improved from 20/30 to 20/20, accompanied by marked improvement in blurriness. The patient was followed up for three years and no recurrence of SRF was noted. Longitudinal change in central foveal thickness during the follow-up and serial SD-OCT scans are presented in [Fig 1](#) and [2](#).

DISCUSSION

The present case report described a case of successful resolution of persistent SRF, achieved after subthreshold MPL application in a patient, who had been previously treated for RRD. The presence of SRF after successful RD repair is a common finding, especially when evaluated by OCT, and can detect subclinical submacular fluid, persisting for months without being recognized on ophthalmoscopy [5, 21, 22]. Sub-retinal fluid is believed to resolve spontaneously in the majority of cases [3, 10, 21]. However, there is evidence that apoptosis of photoreceptors occurs in chronic RD, suggesting that the



longer SRF will be present under the fovea, and the worse functional visual outcome might be achieved [23]. Micropulse laser has been reported to be effective in resolution of SRF in multiple retinal conditions, especially in patients with chronic CSR [14, 15]. It has been

hypothesized that RPE disturbance plays an important role in the pathogenesis of persistent SRF formation, and stimulation of RPE's pumping function may help in SRF absorption, without causing structural and permanent damage to retinal tissue [16].

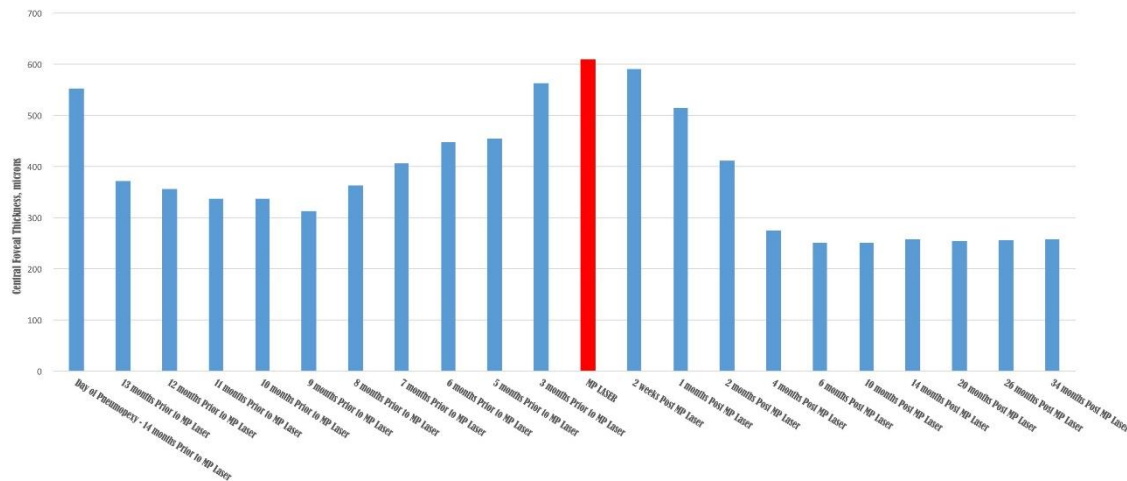


Figure 1: Longitudinal Change in Central Foveal Thickness during the Follow-up



Figure 2: Serial SD-OCT Scans: a) Day of Pneumopexy (PP)– 14 Months prior to Micropulse Laser (MPL), b) Two Months after PP – 12 Months prior to MPL, c) Six Months after PP – Eight Months prior to MPL, d) 14 Months after PP - Day of MPL, e) Two Weeks after MPL, f) Two Months after MPL, g) Four Months after MPL, h) 34 Months after MPL.



The decision of performing MPL in the presented patient was commanded by gradual accumulation of SRF and deterioration of patient's subjective visual complaints while driving, working in front of the computer, reading, and performing other essential daily activities. Shortly after the MPL application, both subjective improvement (marked decrease in visual disturbance) and objective improvement (CDVA improved from 20/30 to 20/20) were observed. It may be speculated that visual improvement in this case was caused by a natural resolution of SRF, since the resolution of SRF may be as lengthy as two years. Nevertheless, the clinical course and dynamics of central foveal thickness changes, which showed gradual deterioration during the follow-up, were reversed by MPL. Micropulse laser treatment served a turning point for clinical improvement, leading to complete SRF resolution within several months, following the MPL application. Patient's vision remained stable and no recurrence of SRF was observed for three years after the MPL application.

REFERENCES

- Kim YK, Woo SJ, Park KH, Yu YS, Chung H. Comparison of persistent submacular fluid in vitrectomy and scleral buckle surgery for macula-involving retinal detachment. *Am J Ophthalmol*. 2010;149(4):623-9 e1. doi: [10.1016/j.ajo.2009.11.018](#) pmid: [20149338](#)
- Kim JM, Lee EJ, Cho GE, Bae K, Lee JY, Han G, et al. Delayed Absorption of Subretinal Fluid after Retinal Reattachment Surgery and Associated Choroidal Features. *Korean J Ophthalmol*. 2017;31(5):402-11. doi: [10.3341/kjo.2016.0033](#) pmid: [28914005](#)
- Desatnik H, Alhalel A, Treister G, Moisseiev J. Management of persistent loculated subretinal fluid after pneumatic retinopexy. *Br J Ophthalmol*. 2001;85(2):189-92. pmid: [11159484](#)
- Chan CK, Wessels IF. Delayed subretinal fluid absorption after pneumatic retinopexy. *Ophthalmology*. 1989;96(12):1691-700. pmid: [2622615](#)
- Seo JH, Woo SJ, Park KH, Yu YS, Chung H. Influence of persistent submacular fluid on visual outcome after successful scleral buckle surgery for macula-off retinal detachment. *Am J Ophthalmol*. 2008;145(5):915-22. doi: [10.1016/j.ajo.2008.01.005](#) pmid: [18329625](#)
- Woo SJ, Lee KM, Chung H, Park KH. Photoreceptor disruption related to persistent submacular fluid after successful scleral buckle surgery. *Korean J Ophthalmol*. 2011;25(6):380-6. doi: [10.3341/kjo.2011.25.6.380](#) pmid: [22131774](#)
- Tee JJ, Veckeneer M, Laidlaw DA. Persistent subfoveal fluid following retinal detachment surgery: an SD-OCT guided study on the incidence, aetiological associations, and natural history. *Eye (Lond)*. 2016;30(3):481-7. doi: [10.1038/eye.2015.270](#) pmid: [26742870](#)
- Ricker LJ, Noordzij LJ, Goezinne F, Cals DW, Berendschot TT, Liem AT, et al. Persistent subfoveal fluid and increased preoperative foveal thickness impair visual outcome after macula-off retinal detachment repair. *Retina*. 2011;31(8):1505-12. doi: [10.1097/IAE.0b013e31820a6910](#) pmid: [21522038](#)
- Federici TJ, Willson RL, Gitter KA. Optical coherence tomography reveals retinal degeneration from persistent submacular fluid after pneumatic retinopexy for rhegmatogenous retinal detachment. *Retin Cases Brief Rep*. 2007;1(4):241-3. doi: [10.1097/01.iae.0000225743.73046.05](#) pmid: [25390990](#)
- Wong R, Orabona GD, Simonelli F, Howard C. Novel technique for removal of persistent subretinal fluid following nondrain retinal detachment surgery. *Taiwan J Ophthalmol*. 2016;6(4):199-200. doi: [10.1016/j.tjo.2016.06.004](#) pmid: [29018742](#)

CONCLUSIONS

The use of micropulse laser for treatment of persistent SRF following a RD procedure resulted in complete resolution of the fluid and retinal reattachment. Further research is necessary to confirm the efficacy, safety, and consistency of MPL in achieving complete resolution of SRF in post-retinal detachment repair patients with persistent SRF.

DISCLOSURE

Ethical issues have been completely observed by the authors. All named authors meet the International Committee of Medical Journal Editors (ICMJE) criteria for authorship of this manuscript, take responsibility for the integrity of the work as a whole, and have given final approval for the version to be published. No conflict of interest has been presented.



11. Veckeneer M, Derycke L, Lindstedt EW, van Meurs J, Cornelissen M, Bracke M, et al. Persistent subretinal fluid after surgery for rhegmatogenous retinal detachment: hypothesis and review. *Graefes Arch Clin Exp Ophthalmol.* 2012;250(6):795-802. doi: [10.1007/s00417-011-1870-y](https://doi.org/10.1007/s00417-011-1870-y) pmid: [22234351](https://pubmed.ncbi.nlm.nih.gov/22234351/)
12. Reichstein DA, Larsen BP, Kim JE. Management of persistent subretinal fluid following retinal detachment repair. *JAMA Ophthalmol.* 2013;131(9):1240-4. doi: [10.1001/jamaophthalmol.2013.2518](https://doi.org/10.1001/jamaophthalmol.2013.2518) pmid: [24030339](https://pubmed.ncbi.nlm.nih.gov/24030339/)
13. Tornambe PE. Pneumatic retinopexy. *Surv Ophthalmol.* 1988;32(4):270-81. pmid: [3279561](https://pubmed.ncbi.nlm.nih.gov/3279561/)
14. Yadav NK, Jayadev C, Mohan A, Vijayan P, Battu R, Dabir S, et al. Subthreshold micropulse yellow laser (577 nm) in chronic central serous chorioretinopathy: safety profile and treatment outcome. *Eye (Lond).* 2015;29(2):258-64; quiz 65. doi: [10.1038/eye.2014.315](https://doi.org/10.1038/eye.2014.315) pmid: [25613846](https://pubmed.ncbi.nlm.nih.gov/25613846/)
15. Shah S, Hariprasad SM. Application of Micropulse Lasers in Treating Macular Diseases. *Ophthalmic Surg Lasers Imaging Retina.* 2016;47(11):985-90. doi: [10.3928/23258160-20161031-01](https://doi.org/10.3928/23258160-20161031-01) pmid: [27842192](https://pubmed.ncbi.nlm.nih.gov/27842192/)
16. Abalem MF, Carricondo PC, Santos H, Garcia R, Qian CX, Helal J, Jr., et al. Confluent Endpoint Subthreshold Argon Laser for Serous Macular Detachment in Tilted Disc Syndrome Refractory to Anti-VEGF. *Ophthalmic Surg Lasers Imaging Retina.* 2017;48(9):760-3. doi: [10.3928/23258160-20170829-12](https://doi.org/10.3928/23258160-20170829-12) pmid: [28902338](https://pubmed.ncbi.nlm.nih.gov/28902338/)
17. Koss MJ, Beger I, Koch FH. Subthreshold diode laser micropulse photocoagulation versus intravitreal injections of bevacizumab in the treatment of central serous chorioretinopathy. *Eye (Lond).* 2012;26(2):307-14. doi: [10.1038/eye.2011.282](https://doi.org/10.1038/eye.2011.282) pmid: [22079961](https://pubmed.ncbi.nlm.nih.gov/22079961/)
18. Roisman L, Magalhaes FP, Lavinsky D, Moraes N, Hirai FE, Cardillo JA, et al. Micropulse diode laser treatment for chronic central serous chorioretinopathy: a randomized pilot trial. *Ophthalmic Surg Lasers Imaging Retina.* 2013;44(5):465-70. doi: [10.3928/23258160-20130909-08](https://doi.org/10.3928/23258160-20130909-08) pmid: [24044709](https://pubmed.ncbi.nlm.nih.gov/24044709/)
19. Gupta B, Elagouz M, McHugh D, Chong V, Sivaprasad S. Micropulse diode laser photocoagulation for central serous chorio-retinopathy. *Clin Exp Ophthalmol.* 2009;37(8):801-5. doi: [10.1111/j.1442-9071.2009.02157.x](https://doi.org/10.1111/j.1442-9071.2009.02157.x) pmid: [19878226](https://pubmed.ncbi.nlm.nih.gov/19878226/)
20. Yadav NK, Jayadev C, Rajendran A, Nagpal M. Recent developments in retinal lasers and delivery systems. *Indian J Ophthalmol.* 2014;62(1):50-4. doi: [10.4103/0301-4738.126179](https://doi.org/10.4103/0301-4738.126179) pmid: [24492501](https://pubmed.ncbi.nlm.nih.gov/24492501/)
21. Wolfensberger TJ. Foveal reattachment after macula-off retinal detachment occurs faster after vitrectomy than after buckle surgery. *Ophthalmology.* 2004;111(7):1340-3. doi: [10.1016/j.ophtha.2003.12.049](https://doi.org/10.1016/j.ophtha.2003.12.049) pmid: [15234134](https://pubmed.ncbi.nlm.nih.gov/15234134/)
22. Hagimura N, Iida T, Suto K, Kishi S. Persistent foveal retinal detachment after successful rhegmatogenous retinal detachment surgery. *Am J Ophthalmol.* 2002;133(4):516-20. pmid: [11931785](https://pubmed.ncbi.nlm.nih.gov/11931785/)
23. Hisatomi T, Sakamoto T, Goto Y, Yamanaka I, Oshima Y, Hata Y, et al. Critical role of photoreceptor apoptosis in functional damage after retinal detachment. *Curr Eye Res.* 2002;24(3):161-72. pmid: [12221523](https://pubmed.ncbi.nlm.nih.gov/12221523/)